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MARCH 7.

The President, SAMUEL G. DIXON, M.D., in the Chair.

Fifteen persons present.

The deaths of the following members were announced: Edward Longstreth, February 24, 1905, and J. Dundas Lippincott, March 6, 1905.

The Publication Committee reported that papers under the following titles had been presented for publication:

"Senility among Gasteropods," by Burnett Smith.

"Notes on some Arctic Fishes, with Description of a New Oncocottus," by Henry W. Fowler.

The Utility Principle in Relation to Specific Characters. — MR. ARTHUR ERWIN BROWN made a communication of which the following is an abstract:

By way of introduction to an argument supporting a broad view of the factors of evolution, such as that taken by Darwin, against the exclusive valuation of Natural Selection urged by Neo-Darwinians, the speaker mentioned that Charles Darwin was elected a correspondent of the Academy on March 27, 1860, the *Origin of Species* having been first published in London on November 24, 1859, and the following extract was read from a letter written by Darwin on May 8, 1860, to Sir Charles Lyell: "This morning I got a letter from the Academy of Natural Sciences of Philadelphia announcing that I am elected a correspondent. It shows that some naturalists there do not think I am such a scientific profligate as many think me here."

The Academy appears to have been the first among scientific societies to confer its honors upon Darwin after the publication of his immortal work.

The opinion of Alfred Russell Wallace as a leading advocate of Neo-Darwinism, that utility has necessarily been the sole factor in the production of specific characters, was contrasted with Darwin's view, and the difficulty of bringing facts to bear against a logical proposition constructed in the form of a closed circle was pointed out. Many biologists have been led by this difficulty to the hasty conclusion that it is useless to cite cases of apparent inutility in face of it; but this view is unfortunate, for thereby the field is abandoned to the advocates of exclusive utility. Furthermore, the accumulation of probabilities by means of such cases is not only legitimate as a method, but at the present time is about the only one by which the argument can be met.

An examination of the evidence for utility in generic and specific characters in serpents was undertaken, chiefly for the reason that the relative simplicity of their organization and the nature of the characters which meet with general acceptance as of taxonomic value seemed likely to afford exceptions to Mr. Wallace's law. The result appears to be that if the validity of specific characters depends solely upon utility, species are few, many genera now including a number of accepted species which Mr. Wallace would be logically bound to reduce to one. Profound structural differences below family rank are not known among snakes. Generic determination is made upon associations of characters, such as the presence or absence of hypapophyses on the posterior trunk vertebræ with endlessly varying details in the form, number and serial proportion of teeth, the arrangement or absence of certain head plates, and differences in the scutellation upon the body. Utility is evident in the presence of ventral hypapophyses, for they supply attachment for bundles of muscular fibres running to the diapophyses of several succeeding vertebræ, which play an important part in throwing the body into curves. They are found in most aquatie species except in *Hydrophinæ*, where they are largely developed upon the tail. But they are present in groups as widely separated otherwise as the so-called *Natricinæ* among colubrine snakes, the *Elapinæ* among proteroglyphs, and in *Viperidæ*. They are, therefore, of no value, taken separately, as measures of affinity. The elapine and viperine snakes are not usually aquatic, and in them utility has doubtless had relation to the rapidity and force required in striking and the need of firm support for the hinder part of the body during the act. In fact, the distribution of these structures seems to afford a true case of convergent evolution.

While utility was primarily concerned in the development of teeth generally, it does not follow that the endless trifling differences in the teeth of *Colubridæ* and *Boidæ* are due to the same cause, for they do not present distinctive types, as in mammals and many lizards, having a mechanical relation to kind of food, but seem, on the whole, to be promiscuously distributed. That such minute differences are due to internal laws of growth and are reached by Natural Selection only when they become hurtful, is much more intelligible than that utility has required such endless variety of minute adaptations. It is admitted that by referring a structure to "laws of growth" no more is accomplished than to express a belief in the action of organic causes whose exact nature is not yet known.

In head plates the differences commonly met with are in the absence or fusion of certain ones upon the snout. That the presence or absence of a minute fissure between any of these plates, which are underlaid by the bony skull and incapable of flexure, can have selective value is inconceivable, and the frequency of their occurrence in degraded, burrowing species points clearly to the probability that they result from the direct action of external stimuli and are of too little importance to be acted upon by Natural Selection. In fact, the almost invariable occurrence of these anomalies in burrowing species is a powerful argument for the agency of external irritations as a cause of change in structure, and the further fact that they have become permanent in such genera as *Stilosoma, Helicops, Haldea, Abastor, Carphophis* and others, certainly indicates that these degradational characters have been inherited. They cannot be "ontogenetic" modifications, for they are exhibited by the newly born young; furthermore, it is of the very nature of ontogenetic modifications that they must be adaptive, while the whole burden of the present argument is to show that those here in question are not of that character. That the complete absence of internasals or loreal is sometimes correlated with a shortened snout and reduced dentition is true, but this condition is not adaptive but degradational. The result of adaptation in burrowing species is seen in *Heterodon,* where the bony snout has been lengthened and made stronger instead of being reduced. In response to external irritations this genus of exceptional burrowers has developed an irregular number of supernumerary plates on the snout, instead of suffering any loss.

The elongation of the rostral, or turning up of it like a plough, is usually regarded as an adaptation related to subterranean habits, and in some cases, as *Heterodon* and *Lystrophis,* it is doubtless true, but the elongation reaches a maximum in *Dryophis,* which is more arboreal than most snakes, and is wholly absent in many others which burrow freely.

In body scales the range of individual variation in the number of rows follows a general law of proportion to the normal mean. In *Colubridæ,* with a minimum of ten and maximum of thirty-five, they rarely vary more than two to six rows, while in *Boidæ,* with extremes of twenty-one and ninety-five, they frequently vary as much as fifteen. Mr. Bateson's law of "meristic" variation seems to be followed. The power of heredity is shown in this relative adherence to a mean, but with the normal range of variation in mind, it cannot be supposed that a slight difference in the number of rows can ever have had selective value to the ancestral form of any species. The fact that the normal number in a species bears a quite definite relation to girth of body, indicates that they are determined by laws of growth. This might be regarded as a correlation, under Mr. Wallace's comprehensive definition, but it may be doubted if size, as a general fact in nature, is conditioned by Natural Selection. It is more likely to be determined by laws of growth reacting to nutritive supply.

The function of keels and scale pits is not known. The last are probably vestigial. Keels may serve a purpose in the swimming habit of aquatic species. In *Hydrophinæ,* where they are not much developed on the dorsal scales, ventral keels are common. With both structures probable utility may be conceded.

The use pertaining to an entire or divided anal plate is not evident. It might appear that a divided anal would be of service in increasing extensibility of the parts involved, but in that case it would be a progressive character, and we have, on the contrary, genera with an entire anal, such as *Eutænia* and *Pityophis,* descended from *Tropidonotus* and *Coluber,* which have the divided form. It is the case, however, that an entire anal is present in all but two genera of *Boidæ,* which are near the base of the series in phylogeny.

Specific determination is made chiefly upon color. Some few cases of color in serpents are protective or warning, but very many species in most large genera are marked by differences in pattern or tint so inconspicuous, that in view of the want of keen eyesight in snakes, it does not seem credible that they can serve the ends usually regarded as useful. The range of color variation in many species is extraordinarily great, and some brilliantly colored species are mainly subterranean, both of which facts are inconsistent with the theory of recognition markings. Recognition in snakes is probably much more served by the olfactory than by the optic sense. Sexual selection cannot be a cause, for few species are known to present differences characteristic of sex.

Pigments in reptiles probably result from waste products of metabolism, which doubtless is influenced by external conditions and food. It is not, however, the existence of color, but its precise distribution in species which is here in question, and the minuteness of the differences in many cases between species of a genus, or between species belonging to distinct genera but occupying the same range, renders it doubtful if the utility principle can be held to explain them adequately. At the same time the subject is very obscure.

The opinion held by the extreme Neo-Darwinians is a deduction from the denial of the inheritance of acquired characters urged by the Weissman school. It is true that the experimental evidence for such inheritance is far from establishing it, but, on the other hand, none but that of negative kind can ever be brought against it, and as a philosophical proposition it has a right to consideration. The further assumption that Natural Selection *necessarily* requires the disappearance of "indifferent" characters which are outside of the law of utility, is unwarranted. As far as is now known, inheritance and variation are ultimate facts of organic life. Congenital variation occurs within relatively narrow limits about a mean, and if it be held that the characters we have been considering have come to be of this kind, so long as they are not injurious but merely "indifferent," no reason can be assigned, aside from the necessity of completing a logical system, why they may not be continued in succeeding generations.

Natural Selection is too often spoken of as if it were a positive force in evolution. It is not so. The struggle for existence is no more than the trial which conditions success, and Natural Selection does no more than determine the failures by means of their detrimental structures. It cannot directly affect those merely neutral.

The fact that characters such as the presence of brilliant colors in subterranean species, and the fusions among head plates which there is especially good reason to regard as "indifferent," have become fixed to the point of specific or generic value, directly contradicts Mr. Wallace's law of exclusive utility. Their continuance, furthermore, would seem to require explanation under a doctrine of absolute non-inheritance of acquired characters.